Banking, Debt, and Currency Crises:
Early Warning Indicators for Developed Countries

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➢ We construct and explore a comprehensive database of crises occurrence in 40 developed countries, focusing on Europe

➢ We try to fill in three gaps in the existing literature:

- focus on a more <u>homogeneous set of countries</u>, not specifically at countries that experienced severe crises

- provide joint evidence on <u>three types of crises</u> with distinction of each type

- add <u>survey of country experts</u> to literature surveys.

➢ The literature on crises is extensive:

- traditionally related to <u>emerging countries</u> (Frankel and Rose, 1996; Kaminsky et al., 1998; and Kaminsky and Reinhart, 1999)

- originally aimed at <u>currency crises</u>, recently also at banking and debt crises (Leaven and Valencia, 2012; Levy-Yeyati and Panizza, 2011; Reinhart and Rogoff, 2011)

- various <u>early warning indicators</u> proposed (Alessi and Detken, 2011; Bussiere, 2013; Reinhart and Rogoff, 2011; Levy-Yeyati and Panizza, 2011).

➢ ...but still a lot of work to find reliable indicators for EU-27.

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Figure 1. Number of developed countries in crisis: 1970:Q1–2010:Q4
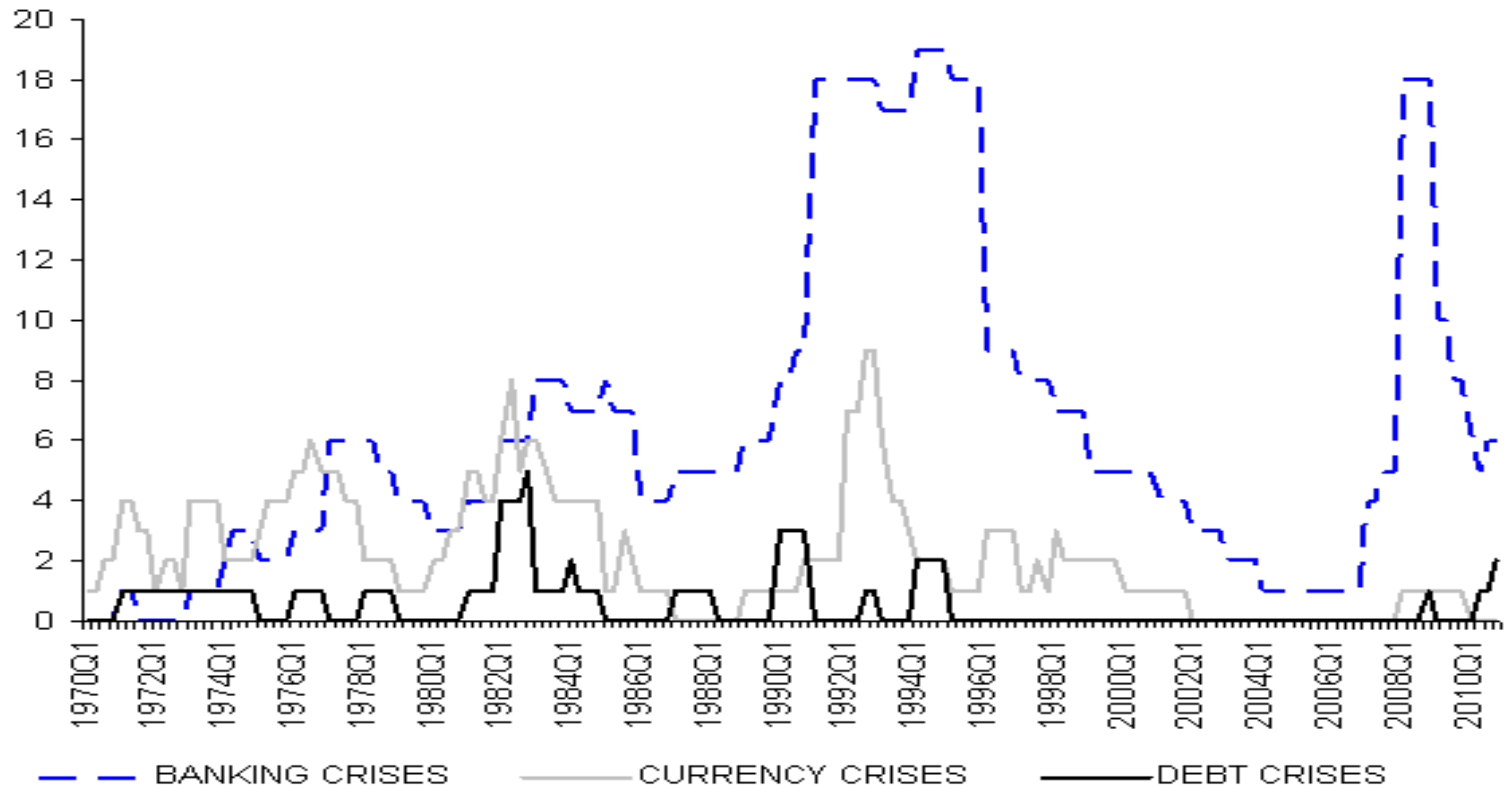
Our database shows that developed countries have had their share of crises.

2. Database of crisis occurrence

➢ A quarterly database of various types of crisis occurrence in EU-27 + OECD for 40 years (1970-2010):

- • Banking crises

- • Debt crises

- • Currency (balance of payment) crises.

➢ We aggregate various sources:

- • Systematic synthesis of the literature

- • Country experts asked for country-specific inputs, the help of the ESCB HoR group acknowledged.

➢ Database available online: http://www.ecb.int/pub/pdf/scpwps/ecbwp1485-annexes.zip

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2. Aggregation issues

➢ For the purpose of our analysis, we <u>aggregated all sources into a binary index</u> for each type of crisis (value 1 when at least one source indicated an occurrence).

➢ Aggregation needed as there is a relevant <u>disagreement between sources</u> (no universal definitions, end of crises often unclear).

- <u>Influential papers:</u> Caprio and Klingebiel (2003); Detragiache and Spilimbergo (2001); Kaminsky (2006); Kaminsky and Reinhart (1999); Laeven and Valencia (2008, 2010, 2012); Levy-Yeyati and Panizza (2011); and Reinhart and Rogoff (2008, 2011).

- <u>Country experts</u> (central banks mostly): add country-specific knowledge (also know more details about timing needed for quarterly data).

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Figure 2. Example of disagreement: Number of quarters spent in banking crises

BANKING CRISES (HoR and MaRs, 2012)   ■ BANKING CRISES (Laeven & Valencia, 2010)
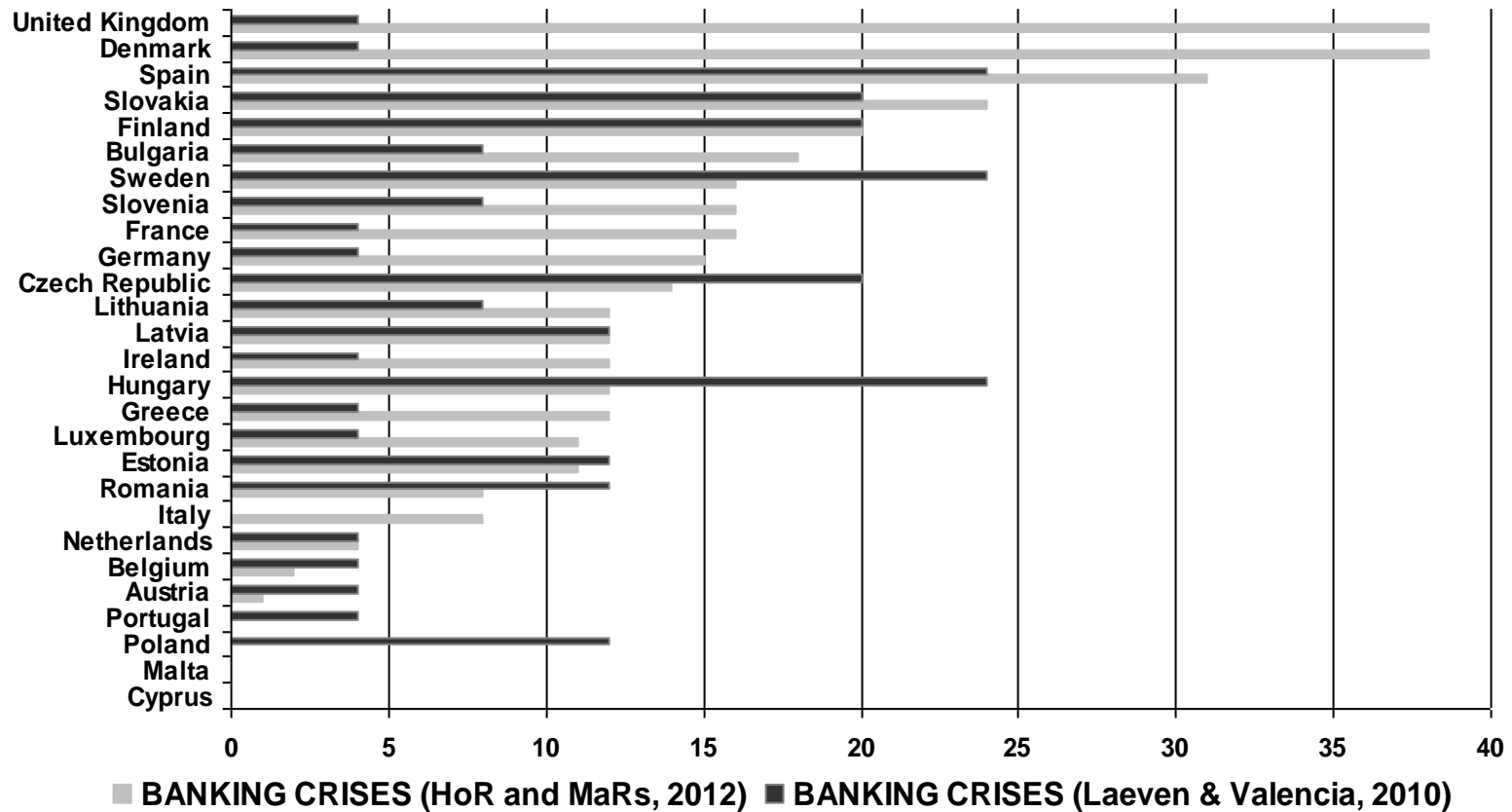
For the EU-27, experts add interesting views compared to the literature.

2. Example of disagreement: Reasons for different coding of banking crises

➢ <u>Banking crises</u> are identified according to: a systemic loss of bank capital, or bank runs, or the size of public intervention in the banking sector.

- Denmark, the UK – older crises unrecorded in L&V, 2010 (Denmark 1987Q1-1992Q4, the UK 1974Q1-1976Q4)
- Czech Republic, Hungary, Poland in 1990s - liberalization and structural changes in the banking sector are not crises.

➢ Our definition in guidelines sent to experts was the same as in L&V, 2010. But our database is able to capture more crises since it uses more sources and complements it with <u>country-specific expert knowledge</u>.
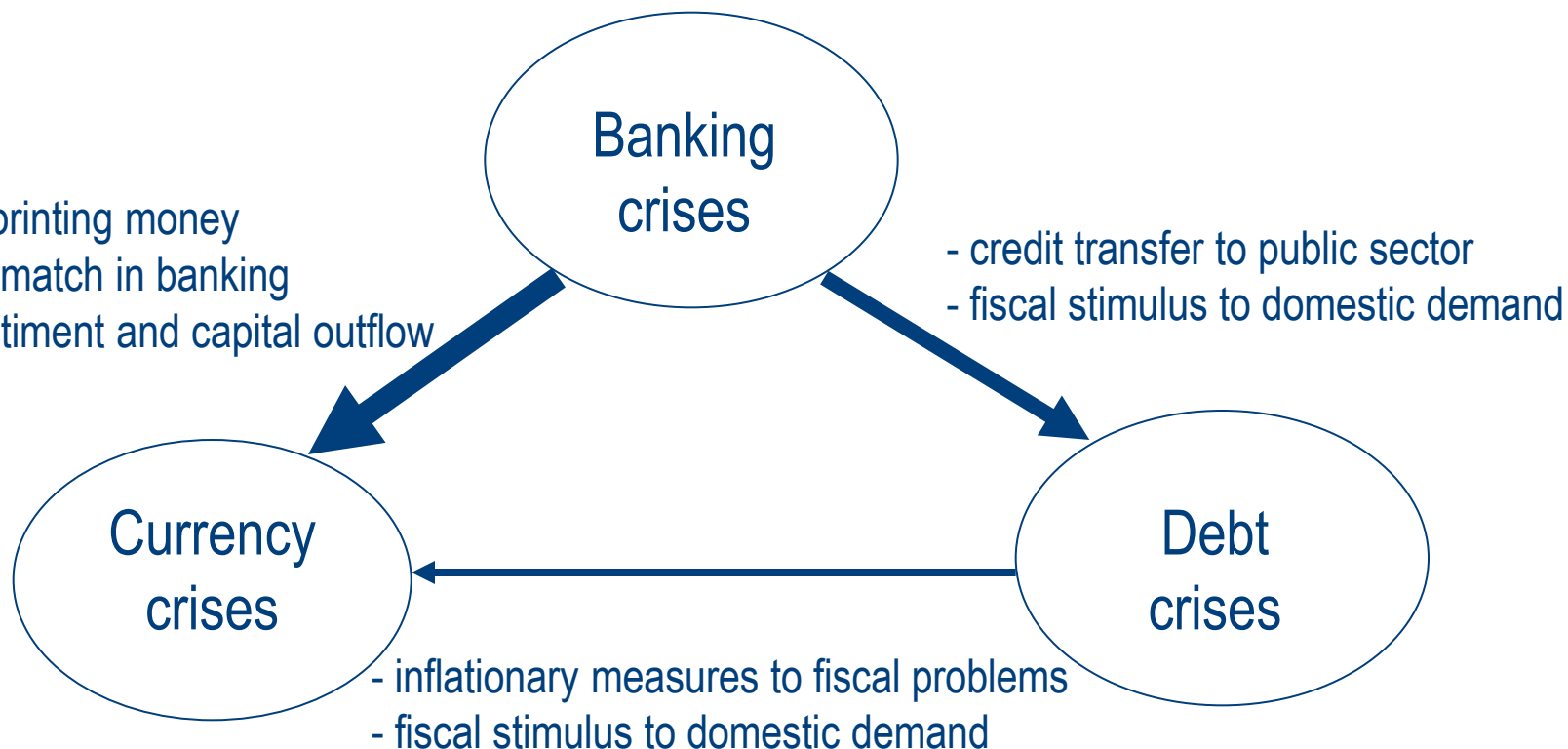
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3. Stylized facts: Crisis occurrence data explored

Crisis type	Number (of 6,560Q)	Mean persistence (prob. 50%)	Mean duration	Simulated GDP loss (cummul.)
Banking	1,047 Q	8 Q	15.2 Q	25 %
Currency (BoP)	343 Q	2-3 Q	4.6 Q	15 %
Debt (fiscal)	90 Q	2-Q	4.1 Q	4 %

Banking crises most important for developed economies so far.

- bail outs by printing money
- currency mismatch in banking
- negative sentiment and capital outflow

- credit transfer to public sector
- fiscal stimulus to domestic demand

Banking crises

Currency crises

Debt crises

- inflationary measures to fiscal problems
- fiscal stimulus to domestic demand

Banking crises drive the other two. Limited feedback loop.

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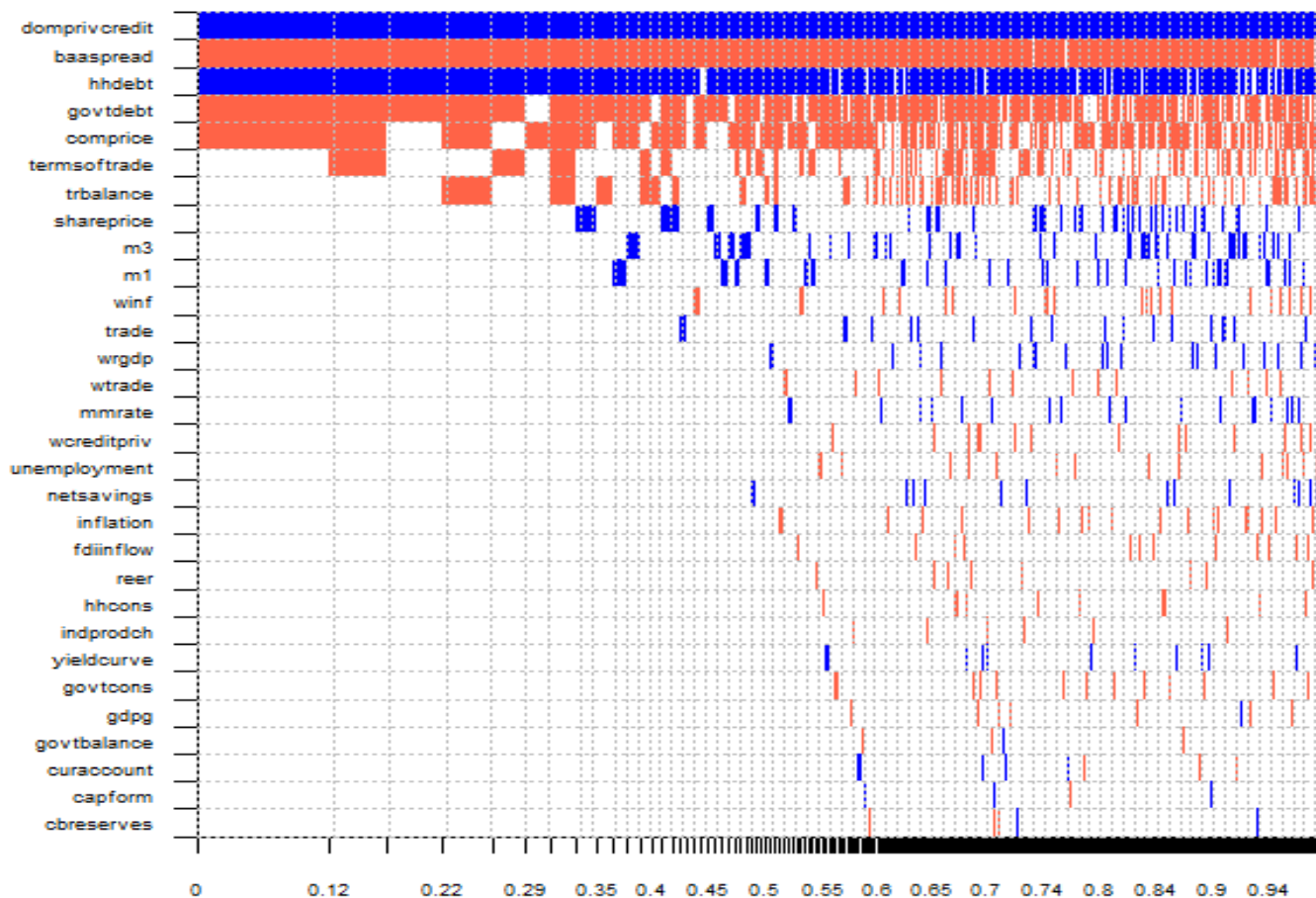
4. Early Warning Indicators of Crises

➤ We use <u>Bayesian model averaging</u> (Madigan and Raftery, 1994; Raftery, 1995, 1996) to determine *onset* of each crisis at 3 horizons windows (Bussiere and Fratzscher, 2006): within 4 Q, from 5 to 8 Q, and from 9 to 12 Q using 30 variables.

➤ <u>This avoids previous empirical problems</u>:

- (i) all potential variables in one regression (inflated standard errors if irrelevant variables included)

- (ii) using sequential testing to exclude unimportant variables (risk of excluding the relevant variable each time the test is performed).

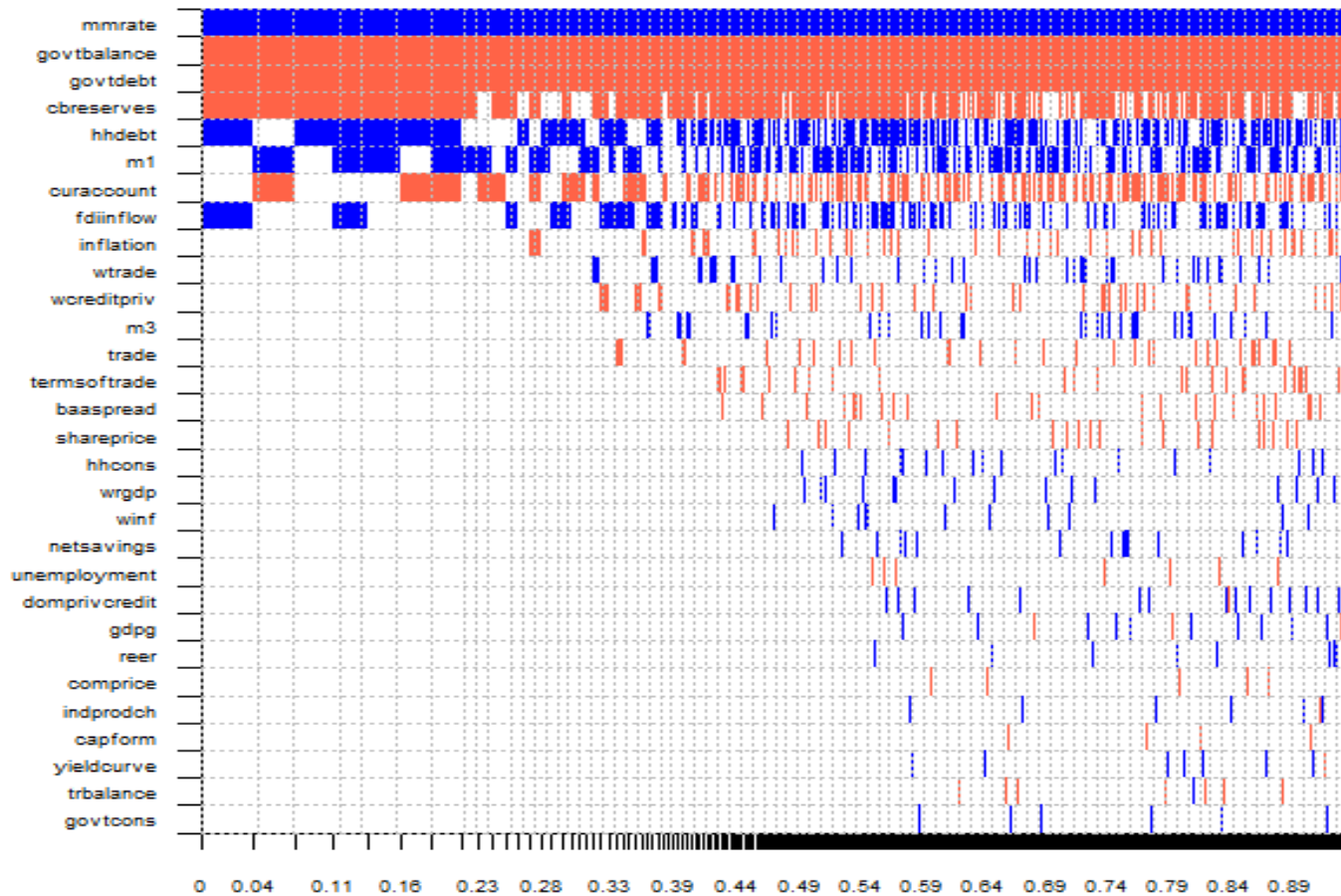# **Figure 3.** BMA: EWI of banking crisis onset, horizon within 4 quarters
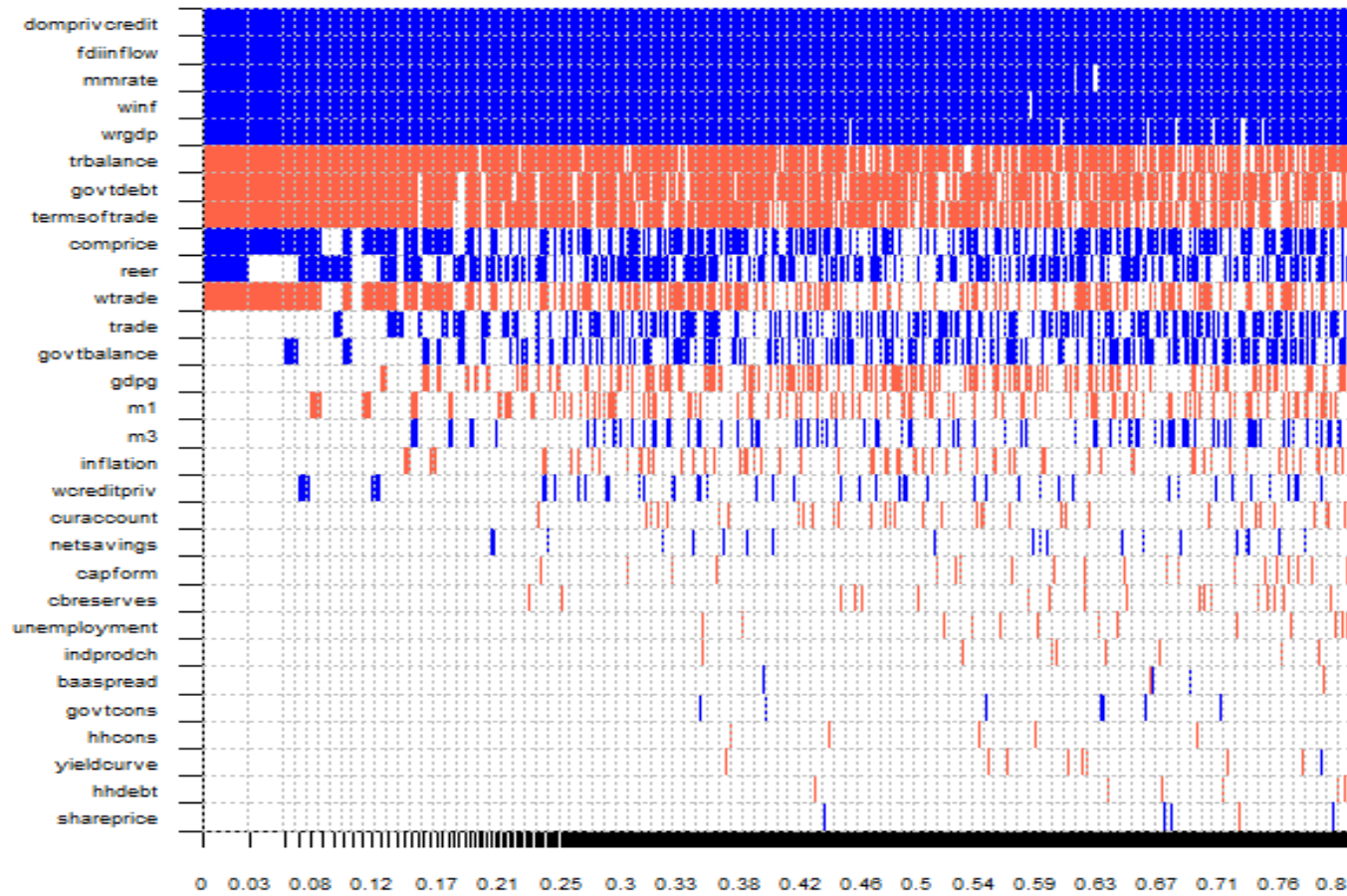
The first eight variables are our best early warning indicators.
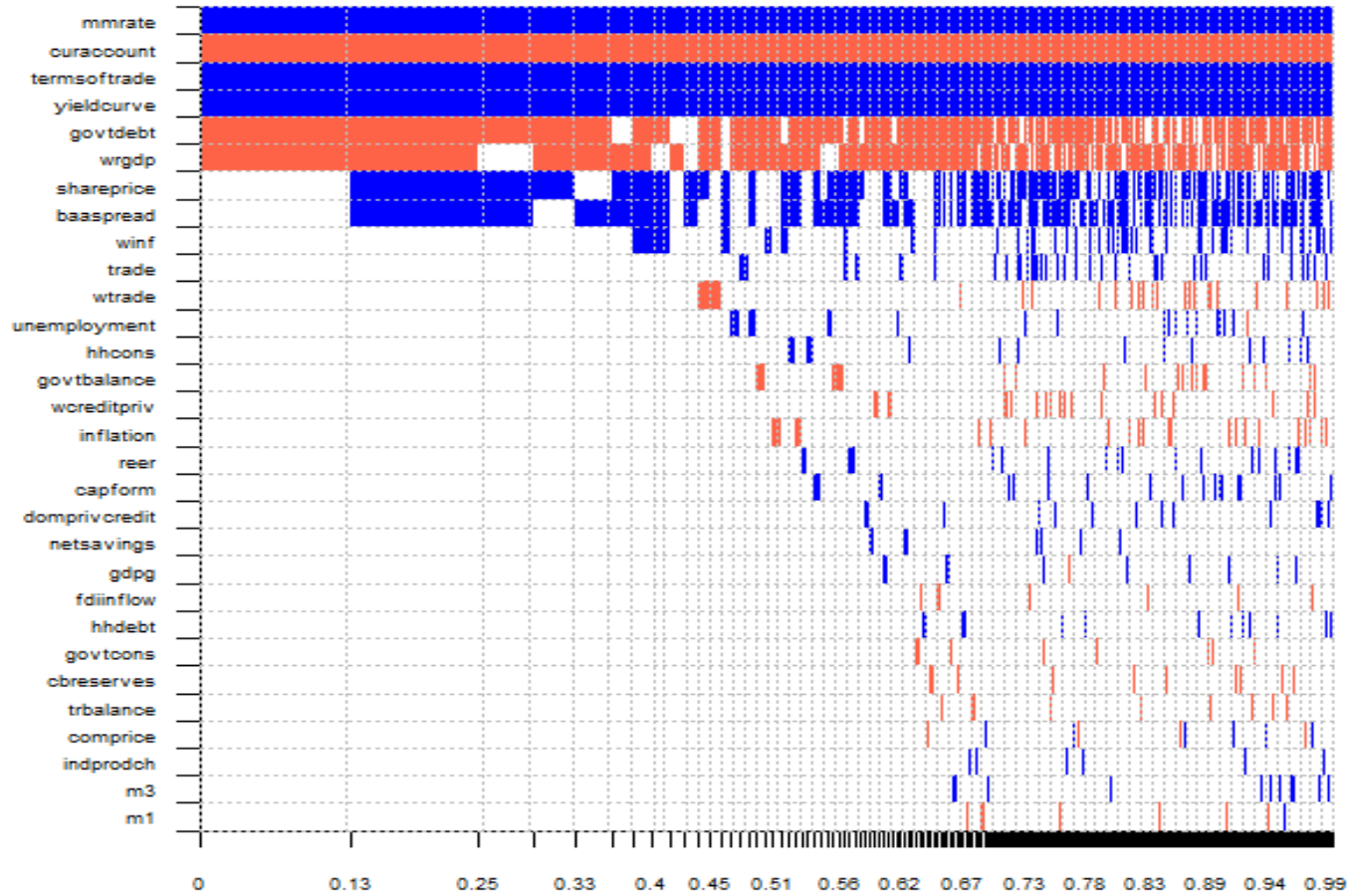
For longer horizons, it is more difficult to find early warning indicators.

Figure 5. BMA: EWI of currency crisis onset, horizon within 4 quarters

Less clear-cut indicators for currency crises.

Difference between horizons less obvious.

4. Early Warning Indicators of Crises

Crisis type	Within 4Q	Within 5-8 Q	Within 9-12 Q
Banking	+ dom.priv.credit + FDI inflows + MM rates	+ dom.priv.credit + FDI inflows - terms of trade - govt. debt	+ dom.priv.credit + hh debt - Baa spread
Currency (BoP)	+ dom.priv.credit - govt. balance - CB reserves - govt. debt	+ dom.priv.credit + MM rates + yield curve - current account - govt. debt	+ MM rates + yield curve - current account + terms of trade

Private credit seems to predict well across crises and horizons.

5. Signaling of domestic private credit growth

➢ What level of credit growth is dangerous?

- the usefulness of private credit vis-à-vis <u>minimizing policy makers' loss function</u> with respect to Type I errors (missed crises) and Type II errors (false alarms)

- The threshold value: the deviation of domestic private credit to GDP by more than 2% from its trend (HP).

	Crisis occurred	No crisis occurred
Warning issued	A (94)	B (444)
No warning issued	C (71)	D (2753)

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Thank you for your attention

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Link to ECB WP and the crises database:
http://www.ecb.int/pub/pdf/scpwps/ecbwp1485.pdf
http://www.ecb.int/pub/pdf/scpwps/ecbwp1485-annexes.zip
Project website: http://ies.fsv.cuni.cz/en/node/372

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